NOTES ON LITHOTRITY,
WITH
AN ACCOUNT OF THE RESULTS OF THE OPERATION
IN
THE AUTHOR'S PRACTICE.

BY
SIR BENJAMIN C. BRODIE, BART., D.C.L., V.P.R.S.,
CORRESPONDING MEMBER OF THE ACADEMY OF SCIENCES OF THE IMPERIAL
INSTITUTE OF FRANCE; SERJEANT-SURGEON TO THE QUEEN;
SURGEON TO HIS ROYAL HIGHNESS PRINCE ALBERT;
FORMERLY SURGEON TO ST. GEORGE'S HOSPITAL;
ETC., ETC.

Received March 1st.—Read March 13th, 1855.

ALTHOUGH the operation of lithotritry has been for many years extensively and successfully practised in a neighbouring country, it has hitherto been adopted only to a limited extent by British surgeons; yet, if I may be allowed to judge from the results of my own experience of it, it must be regarded as a method of relieving those who suffer from calculus of the bladder which is attended with much less uncertainty and danger—being at the same time much less formidable to the patient—than the operation of lithotomy. With the strong conviction which I have of these advantages, I do not hesitate to comply with the desire lately expressed by our president, Dr. Copland, and formerly by his predecessor, Mr. Hodgson, that I would bring the subject before the Royal Medical and Chirurgical Society. In doing so, however, I do not presume to trouble the Society with anything like a systematic treatise on lithotritry. The object which I have

in view will be better obtained in a less formal way : and I propose, first, to communicate, in a series of notes, some observations as to those circumstances which are especially deserving of attention, as affecting the success of the operation ; secondly, to give a brief but accurate account of the actual results which I have met with in my own practice, from the time when I first performed the operation, down to the present period ; and, lastly, to add some observations as to the amount of danger involved in the removal of calculi by crushing compared with that which belongs to lithotomy. I can have no better opportunity than the present of offering such a communication, as, having for some time declined the operative part of my profession, it is not probable that any further delay will enable me to make any very important additions to whatever knowledge of the subject I now possess.

§ 1.

1. I have never performed the operation in young persons below the age of puberty. The operation of lithotomy in the cases of children is so generally successful that it has not appeared to me that, as to them, any deviation from the old method of treatment is required ; while, on the other hand, the small capacity of the urethra, and the difficulty which must attend the introduction of a forceps sufficiently large to crush a calculus of any considerable size seems to render them unfit subjects for lithotrity.

There is another very sufficient objection to the last-mentioned operation in children ; namely, that, instead of being completed at once, as in the instance of lithotomy, it is for the most part necessary that it should be repeated several times, and that such a repetition requires a degree of patience and self-control, and thought of the future, which children can scarcely be expected to possess.

2. I have not myself performed the operation of lithotrity on females. That I have not done so has arisen partly from the circumstance that in them cases of calculus of the bladder are rare as compared with those which occur in

the other sex, partly from the facility with which the female urethra may be dilated so as to admit of the extraction of a calculus of moderate size; and partly from the belief that the bladder would not easily retain the quantity of water necessary to the safety of the operation. I am, however, inclined to believe that as regards the last-mentioned objection I have been in an error, as Mr. Fergusson informs me that he has crushed calculi in the female bladder without difficulty, and with perfect success.

3. The forceps which I have been in the habit of using is that made by Weiss, with a handle sloping downwards, and a simple screw. For ordinary cases, a forceps of very moderate size is sufficient; for cases of very large calculi it is prudent to use a larger and a stronger instrument. I have never met with a single instance in which, however large it might be, a calculus once seized by the forceps did not yield readily to the pressure of the screw; or in which any harm happened from the bending or breaking of the instrument. I have lately seen a forceps in which the force intended for crushing the calculus is applied by means of a short cylindrical rod, introduced laterally, with some projecting teeth acting on a rack on the anterior part of the sliding blade. Such an instrument may afford some small advantage in the way of greater expedition, and so far may not be objectionable in cases of very small calculi, but it is evident that, as compared with the forceps with a screw, it must be very deficient in power, and that it would be very unsafe to have recourse to it in cases of calculi beyond certain dimensions.

4. The peculiar shape of the extremity of the forceps (without which it would not answer the intended purpose) renders it less easy to be introduced into the bladder than an ordinary sound or catheter, and a certain degree of force is generally required to enable it to pass through the urethra where it is surrounded by the prostate gland, such as is not at all necessary in using either of the last-mentioned instruments. The manœuvre necessary for this purpose cannot well be described in words, but it is easily

acquired, and it may be learned by practising on the dead quite as well as by practising on the living body. It is only in cases of considerable enlargement of the prostate gland that any real difficulty in the introduction of the forceps exists; but even in such cases I have never met with an instance in which the difficulty was not overcome by a cautious and gentle manipulation, nor with any in which any injury was done to the neck of the bladder in this part of the operation.

In using the forceps it is important that no attempt should be made to open the blades until the sudden cessation of the resistance offered by the prostate gland shows that they have fairly entered the bladder. The blades may be partially separated while a portion of the curved extremity is still in the urethra; but a certain effect of this is that the patient is subjected to much unnecessary pain, at the same time that there is great danger that the injury thus done to the verumontanum and orifices of the seminal ducts may induce inflammation of one or even of both of the testicles.

5. No prudent surgeon would willingly undertake the operation unless the bladder admitted of the injection and retention of from at least four to six ounces of tepid water. In cases in which the bladder has lost its power of retention, it may generally be restored by keeping the patient for a week or fortnight in the recumbent posture, and at the same time injecting some tepid water once daily into it. This method has failed with me only in a single instance. In consequence of the failure, I had recourse to lithotomy, and extracted a very large calculus, composed of the oxalate of lime, with angular projections on its surface, which sufficiently explained the irritable state of the bladder. The patient died in a few days after the operation.

Although, as has been just observed, the operation should never be attempted without the bladder having been previously distended with tepid water, it is worthy of notice that it has occurred to me sometimes to find that during the operation the whole of the water which had been

injected had escaped by the urethra, without my being at the time aware of the circumstance; so that many fragments must have been crushed in an otherwise empty bladder. On such occasions I have always been apprehensive lest some ill consequences should ensue. It is true that this did not happen in any one instance; still it is a thing that ought to be carefully avoided, as it is plain that any but the most careful manipulation with the forceps would be dangerous under these circumstances.

6. The most important part of the operation is undoubtedly that of seizing the calculus with the forceps; and this may be dangerous and difficult, or safe and easy, accordingly as the surgeon is or is not acquainted with the right method of proceeding.

The rule should be to *move the forceps in the bladder as little as possible*, never using it as a sound for the purpose of exploring the bladder, or ascertaining the position of the calculus. Such an examination does not assist the surgeon in seizing the calculus afterwards; it gives pain to the patient, excites the bladder to contract and expel the water which had been previously injected; and I know that instances have occurred, though not in my own practice, in which a rough handling of the forceps has caused great injury to the bladder, ending in the death of the patient. The rule for seizing the calculus (which I must acknowledge to have first learned from witnessing the very dexterous operations of M. Heurteloup) is as simple as possible. The patient lying on his back, the handle of the forceps is elevated, which of course brings the convex part of the curved extremity of it in contact with the posterior surface of the bladder, where it is contiguous to the rectum. The forceps is then to be opened, by withdrawing the sliding blade to a greater or less extent, according to the probable size of the calculus, the fixed blade being at the same time pressed gently downwards, in the direction of the rectum. The object of this manipulation is, that the forceps, being below the level of the other parts of the bladder, the calculus may fall into it by its own weight; and it is generally successful.

If it should not do so, the forceps, without being moved from its situation, may be gently struck with the hand on one side, or on its anterior part, and the slight concussion thus communicated to the bladder will probably be sufficient to dislodge the calculus, and bring it within the grasp of the instrument. If it should be otherwise, the forceps being closed, may be very gently and cautiously turned to one side or the other, so that the curved extremity of it may make an angle of twenty-five or even thirty degrees with the vertical line of the body, then opened, and pressed in the direction of the rectum in the manner already described.

When the prostate gland is much enlarged, there is sometimes a difficulty in seizing the calculus, arising either from it lying under that part of the gland which projects into the bladder, or from the impediment which it offers to the elevation of the handle of the instrument. For such cases the operating table invented by M. Heurteloup, which enables the patient's shoulders to be suddenly lowered, is very convenient; or the same purpose will be answered sufficiently well if the patient be placed on a light sofa, the end of which may be raised by an assistant. The calculus is then seized, not in that part of the bladder which adjoins the rectum, but in the fundus, this being rendered the lowest point by the elevation of the pelvis.

If the calculus does not at once drop into the blades of the forceps, the patient may be directed to walk round the room, or to change his position as he lies, by turning first on one side and then on the other, the bladder being afterwards emptied by the catheter, and then again injected with tepid water. By these means the calculus is made to change its position, and may often be readily seized, though it could not be so previously.

7. In the early part of my practice, I was accustomed to use a forceps so constructed that a greater or smaller portion of the crushed calculus was always retained between the blades. In this way a considerable quantity of calculous matter may be removed at each operation, and the patient may, to a great extent, be saved from the trouble of passing

it afterwards with the urine. There are, however, some very grave objections to this mode of proceeding. The withdrawing of the forceps, if much loaded with calculous matter, stretches the urethra beyond its natural diameter, and in so doing, not only gives the patient much pain at the time, but renders him liable to rigors afterwards; secondly, in four instances in which I had adopted this practice, the urethra was torn, and an infiltration of urine into the surrounding tissues, followed by urinary abscess, was the consequence. Two of these patients, in whom the mischief produced was deep in the perineum, died, notwithstanding the abscesses having been freely opened as soon as they were detected.

The experience of these cases led me some years since to discontinue the use of the forceps already referred to, or, at least, to have recourse to it very rarely, and only under some special circumstances, and to substitute for it a forceps made by Mr. Weiss, in which there is a longitudinal opening in the curved part of the fixed blade, with a corresponding projection in the opposite or sliding blade. The effect of this instrument is to crush a calculus very completely, and in such a way that no part of it remains between the blades, the whole being left to be passed with the urine afterwards. The ultimate cure of the patient may, in some instances, be thus a little (but not greatly) protracted; but this inconvenience is more than compensated by the smaller amount of pain which the patient suffers, the smaller liability to rigors, and the complete absence of danger from the infiltration of urine and perineal abscess.

8. An important question arises, to what extent may a calculus be crushed at one operation. In the dead body the largest calculus may at once be reduced to atoms. But it would be very unsafe to attempt to do this in the living person; first, the time during which the bladder will retain the water injected into it is limited—and, for the most part, it begins to escape in a few minutes after the introduction of the forceps; secondly, the only part of the operation during which the patient much complains of pain is the

instant of the attempt being made to seize the calculus, the pain then evidently arising from the pressure of the forceps on the neck of the bladder. Now I have observed, that where the crushing of the calculus had been, during one operation, very frequently repeated, more or less inflammation has always followed, extending from the neck of the bladder to the mucous membrane, causing a great mucous secretion, and preventing a repetition of the operation for a considerable time afterwards; and hence I have come to the conclusion that it is a more prudent, and in the end a more expeditious mode of proceeding, to be content, on any one occasion, with crushing the calculus only to a moderate extent. At the same time, it is plain that no general rule can be laid down as to how much can be prudently accomplished. The surgeon must use his own discretion, being guided chiefly by the amount of inconvenience which the patient suffers. In one case, twelve or fifteen fragments may be safely crushed, in another not more than six or seven. The consideration of what has now been mentioned leads me, on the whole, to prefer not putting the patient under the influence of chloroform, as it prevents the patient from describing those sensations, which may help to direct the surgeon in his practice.

9. There is another reason for not being anxious to do all that can possibly be done at any one operation, namely, the greater liability that this occasions of the operation being followed by a rigor. For the same reason, it is important that the urethra should not be stretched beyond its natural diameter, either by the use of very large instruments, or by the withdrawing of the forceps loaded with the fragments of the calculus. It may be necessary in a few cases that a very narrow urethra should be dilated, but this should be gradually accomplished by the introduction of bougies, the operation itself being deferred until the dilatation is completed. In all cases, however, there is more or less risk of the occurrence of a rigor unless due precautions are taken to prevent it. With this view, I always advise that the patient should go to bed afterwards, with an additional blanket over

him, the bed itself being previously warmed in cold weather. I was accustomed formerly to prescribe a dose of the *Pulvis Ipecacuanhæ Compositus*, or some other opiate, to be administered after the operation. For the last few years, however, I have preferred giving the patient a tumbler of hot wine and water, or brandy and water. It seems to me that this is more effectual in preventing a rigor than the opiate, at the same time that it has the advantage of not inducing costiveness or headache afterwards.

I need scarcely add, that it is important on all occasions that nothing should be omitted which may tend to lessen the liability to rigor. Even in the most healthy persons, it is followed by more or less depression of the vital powers, and prolongs the interval which must elapse before the operation can be repeated; while, under certain circumstances, when calculus of the bladder exists, in combination with other disease, it may be actually dangerous to life. I shall have occasion to refer to this subject in reference to the complication of renal disease hereafter.

10. When a calculus has been crushed of so small a size that two or three applications of the screw were sufficient for that purpose, it may be that the fragments will be immediately passed with the urine, so that the bladder may be quite free from them, and the cure of the patient completed in the course of two or three days. When, however, it has been necessary at any one operation to repeat the crushing process several times, for the most part very few of the fragments, and sometimes none at all, are passed during the first three or four days, or it may be even for a week. The explanation of this I apprehend to be, that the pressure of the forceps on the neck of the bladder, which I have already mentioned as the principal inconvenience to the patient at the time of the operation, occasions some degree of inflammation and tumefaction of the prostate gland afterwards, sufficient to prevent the escape of the fragments in the first instance. That nothing may interfere with the neck of the bladder recovering its natural condition, it is desirable that the patient should remain quiet for the first two

or three days on a sofa. Afterwards, with a view to the more free discharge of the fragments, I have generally advised him to walk gently about the house, or even a short distance out of doors, during a part of the day, and to drink plentifully of barley-water or some other diluting liquor. At the same time, all violent exercise, such as rapid walking or running, should be avoided, as it might occasion the urethra to be blocked up by the too rapid escape of the fragments from the bladder. The patient, in some instances, suffers a good deal of inconvenience from a fragment of the calculus being lodged in the urethra, especially in the membranous part of the canal. Various kinds of forceps have been contrived for the purpose of removing the fragments under these circumstances, and I have in two or three instances used them with advantage where a calculus had been lodged in the space between the glans and the scrotum. I cannot say that the forceps may never be required where a fragment is lodged in the posterior part of the urethra, or even that it may not be necessary to extract it by an incision in the perineum. Such a case, however, has not occurred in my own practice. It so happens that I have always succeeded in dislodging the fragment by two or three times introducing a rather small elastic gum catheter, and thus altering the position which it occupied in the urethra. I may take this opportunity of observing, that it is very important to avoid cutting down on the urethra immediately in front of the scrotum. In two instances in which I thus removed a calculus, not after crushing, but where it had been extracted from the bladder entire, by the method proposed formerly by Sir Astley Cooper, notwithstanding the immediate introduction of an elastic gum catheter, and the retention of it in the bladder, a small quantity of urine found its way into the cellular tissue of the penis and scrotum, causing a series of troublesome abscesses afterwards.

In an elderly person, in whom there is usually more or less enlargement of the prostate gland, the fragments do not come away so readily as in those who are younger. This especially happens where the patient has lost the power of

emptying the bladder by his own efforts. It would be a mistake, however, to suppose that the incapability of expelling the whole of the urine prevents them from coming away altogether: still the process is more tedious, and requires some assistance beyond that which is required under ordinary circumstances. Firstly; the patient should be directed to void his urine stooping forward, or even in the recumbent posture, lying with his face downwards. Secondly; tepid water should be injected by means of a syringe, or elastic gum bottle, through a large silver catheter, having a wide aperture near its extremity on the concave side, by which means fragments below a certain size may be washed out of the bladder. This may be done daily, the injection being repeated on each occasion three or four times. In one instance, in which a complete retention of urine followed the crushing of a large calculus, in the course of two or three weeks the whole of the fragments were thus brought away, the patient regaining the power of emptying the bladder afterwards.

11. Where the presence of a calculus has excited inflammation of the mucous membrane of the bladder, indicated by excessive irritability of that organ, and a copious secretion of mucus from its membranous surface, I have generally deemed it prudent to defer the operation for a time, the patient remaining at rest in the recumbent posture until the inflammation has in some degree subsided. This state of things, however, unless the inflammation is excessive, does not form an absolute objection to the operation, though it may be a reason for proceeding more cautiously than if the bladder were in a perfectly healthy state. Indeed it often happens that the first crushing of the calculus, by distributing its weight over a larger surface of the bladder, is followed by a marked improvement of the symptoms, the pain which the patient suffers being immediately diminished, and the mucous secretion reduced in quantity.

In the great majority of instances the crushing of a calculus may be repeated at moderate intervals, without any signs of inflammation, or any very large secretion of mucus

being induced. In other instances it is quite otherwise. This may depend on circumstances altogether beyond our control, some individuals being more and others less susceptible of inflammation. Much, however, depends on the operator. I have already observed that if, from an over anxiety to obtain a speedy cure, the operation on any occasion be much prolonged, the probability of such ill consequences is much increased: and I need scarcely add, that the same result is to be expected from any rough manipulation with the forceps.

12. It has been objected to this mode of removing calculi that there is always a risk of a fragment remaining in the bladder, and causing a recurrence of the disease; and it is quite true that this may well happen without great caution and vigilance on the part of the operator. A single small fragment may escape detection, however carefully the examination of the bladder may be conducted, especially where there is any considerable enlargement of the prostate gland. Still it may be detected at last, and the patient should not be finally dismissed as cured while any of the symptoms of calculus of the bladder remain. It has happened to me, in three different instances, to make more than one most careful examination of the bladder, without discovering a fragment which has at once fallen within the grasp of the forceps, when the examination has been repeated a few weeks afterwards. I may take this opportunity of observing, that where the calculus, or fragment of a calculus, is of a small size, the forceps affords a much more certain means of exploring the bladder than the common sound or catheter, the latter instruments being, in fact, very inefficient for this purpose.

In a case of diseased and sacculated bladder, it is plain that a fragment lodged in one of the sacculi, not only cannot be crushed, but may escape detection altogether. One such case has occurred in my own practice. A gentleman laboured under a calculus of the bladder, complicated with an enlargement of the prostate gland, which prevented his emptying the bladder by his own efforts, and made the

constant introduction of the catheter necessary. The calculus had been crushed, but much irritation of the bladder remained, which I was led to attribute to the disease of the prostate gland. After some months the patient died, and the body was examined by Mr. Bowling, of Hammersmith, who found the prostate gland much enlarged; abscesses in the kidneys; a fasciculated and sacculated bladder, and a fragment of the calculus impacted in one of the sacculi.

13. There is some difference in the operation in different cases, depending on the chemical composition of the calculus. A calculus composed of oxalate of lime requires a greater force to crush it than one of the same size composed of lithic acid. It is important that one of the former kind should be crushed as completely as possible, as otherwise the urethra is liable to be irritated by the sharp angles presented on the surface. A calculus composed of the triple phosphate, or of the mixed phosphates, or more especially of the pure phosphate of lime, is more easily crushed than one of lithic acid; so that if of a small size the mere pressure of the thumb will often be sufficient, without the application of the screw. When there is disease of the bladder, with a constant exudation of adhesive alkaline mucus from the lining membrane, phosphate of lime is continually being deposited in small masses like a soft mortar, which, if allowed to remain become aggregated, and form the nucleus of a large calculus. It is important that such a result should, if possible, be prevented. I have elsewhere published an account of a case of this description,¹ in which a very large accumulation of deposits of this soft phosphate of lime had taken place, causing great suffering to the patient, but which I was enabled to remove by means of a forceps having the fixed blade made concave, so as to answer the purpose of a scoop, without the use of the screw; the bladder being regularly washed out afterwards to prevent any further accumulation from taking place.

14. That which I have just mentioned belongs to a class

¹ 'Lectures on the Diseases of the Urinary Organs,' 4th edition, p. 301.

of cases in which a cure of the disease is out of the question ; and in which the operation of lithotomy would be attended with so much danger that no prudent surgeon would undertake it ; but in which, nevertheless, great advantage may be obtained by the use of the lithotriety forceps. In the cases to which I refer there is a permanent and incurable disease of the bladder, induced originally by a tumour of the prostate gland projecting into it, or in some other way, the calculous matter being deposited, not by the urine, but by the secretion of the mucous membrane. When collected in a certain quantity, by irritating an inflamed and highly sensitive organ, it becomes a source of most intense suffering far beyond what occurs in ordinary cases of calculous disease. We have, for the most part, no means at our disposal, by which, in such cases, the deposit of the phosphate of lime can be altogether arrested : but, by watching the patient carefully, and removing from time to time the small calculi as they are generated, the sufferings which they would otherwise produce may be mitigated or prevented. Two or three such cases have occurred in my own practice, in which I was enabled, not ultimately to preserve, but to lengthen, the patient's life, and so that he passed the remainder of his days not in a state of absolute ease and comfort, but with a far less amount of suffering than would have been the case otherwise.

15. It is not uncommon for the operation to be productive of a slight hemorrhage, sufficient to discolour the water drawn off from the bladder, or even the urine, for two or three days afterwards. The blood seems to proceed from the neck of the bladder, and probably arises from the pressure made by the forceps on the prostate gland in the act of seizing the calculus. I have never, in my own practice, met with hemorrhage to any considerable extent, or such as to interfere with the progress of the cure. It is plain, however, that in a case of enlarged and very vascular prostate gland a greater hemorrhage might occur under the most careful treatment : otherwise its occurrence must be regarded as evidence of the forceps having been too roughly used,

without that degree of caution and lightness of hand which I have already mentioned as being absolutely necessary to the success of the operation.

16. The advantages of lithotritry are certainly most conspicuous in cases of small calculi, where a cure may be effected by one or two operations, so that the patient, in the course of four or five days, finds himself free from the pain and anxiety belonging to a most formidable disease, and able to resume his usual occupation. There are undoubtedly cases in which the magnitude of the calculus is such that it would be impossible to seize it with the lithotritry forceps, or to crush it if seized, and in which the patient is reduced to the alternative of a miserable death from the disease, or of taking the very small chance, which, under such circumstances, lithotomy affords him of a cure. Such cases, however, are, according to my experience, rare exceptions to the general rule; calculi of very considerable dimensions may be crushed with ease and safety. I have, in some instances, when the calculus was seized, found that the blades of the forceps have been separated to the extent of an inch and a half, yet have found no difficulty in the operation, nor any other inconvenience than that of having to repeat it oftener than when the calculus was of smaller diameter. In the year 1844, in a case which the late Mr. Aston Key attended with me in consultation, from the length of time during which the symptoms had existed, and from such examination as we were able to make, we were led to apprehend that the calculus might be of so large a size that crushing it would be impracticable. However, we determined that the operation should be attempted. I had a forceps made for the purpose, larger and of greater power than those which I had previously used, and we were agreeably disappointed to find that it yielded at once to the force which I was thus able to apply, the fragments being afterwards gradually reduced by means of the ordinary instruments.

It must be observed, however, that where we have recourse to this operation it is difficult to determine the exact size of the calculus. We have no means of knowing whether it be

seized in its longest or in its shortest diameter. The fragments which come away may be preserved and weighed, but these are no measure of what is actually destroyed, as many of the smaller fragments may be entangled and lost in the mucus, and so much of the calculus (especially where it consists of the phosphatic salts) is always reduced to a state of impalpable powder, which renders the urine opaque, but is otherwise imperceptible to the eye, though it may be detected by chemical analysis.

§ 2.

Having made these observations as to the points which principally demand the attention of the surgeon, in connection with the operation of lithotritry, and having offered those suggestions which, according to my experience, are most important with a view to its favorable termination, I shall endeavour to communicate to the Society, as nearly as I can, an exact account of the actual results of my own practice. In doing so it will be my especial object to describe, however briefly, the cases in which the operation, in my hands, has proved to be unsuccessful, and the causes which have led to its failure. I have the means of doing this with sufficient accuracy, as I have the advantage of referring not only to my own notes, but to those of my friend and former pupil Mr. Charles Hawkins, who has assisted me for many years past in the great majority of cases which have come under my care, and has preserved notes of every one of them.

From these two sources I obtain an account of 111 cases. There are a few others of which I have no written memoranda; and these being scattered over a period of twenty years, I cannot charge my memory with an accurate recollection of them. They are probably as many as nine or ten; but that I may not incur the risk of magnifying the extent of my experience, I will set down the whole number of cases under my care as being no more than 115. I am aware that this is a small number compared with those which have been treated by my friend M. Civiale, and some

other surgeons in Paris, who devote themselves especially to this branch of our profession. It is, however, I apprehend, quite sufficient to enable any one who is a careful observer to make himself acquainted with all the more important points of practice.

When I speak of having performed the operation in 115 different cases, I do not mean to say that these occurred in the same number of individuals. One great advantage which this operation has over that of lithotomy, is that, being less formidable to the patient, he is not unwilling to undergo it again and again if there should be such a liability to calculous disease as to render it necessary. There was a gentleman whom I attended, in conjunction with the late Dr. Prout, in whom the tendency to the deposit of lithic acid was so great that none of the methods commonly in use, nor any others which we were able to devise, had any sensible influence over it. Originally the deposit had been in the form of lithate of ammonia, the surface of the vessel being always stained of a red colour. Afterwards it assumed that of renal calculi. Several of these were voided from time to time, while others, being of greater magnitude, remained in the bladder, and required to be crushed. The operation was performed on this patient as many as eight times in the course of the same number of years, always with complete success. He died at last the victim of cerebral disease;—a not uncommon termination of those cases in which there is so great and uncontrollable a disposition to the production of lithic acid in the blood. In another patient, who was also under the joint care of Dr. Prout and myself, there was a similar liability to the formation of renal calculi; but they were generally of a small size. I removed at various times, probably more than one hundred calculi of the size of hemp-seeds, by means of the scoop-forceps; but on two or three occasions, the calculi being of a larger size, it was necessary to crush them. In three other cases I had to perform the operation a second time. It is to be observed that I refer here to cases in which there could be no doubt that the calculi were altogether fresh formations, and that I carefully exclude the

very few instances that have occurred to me, in which a recurrence of the symptoms might be reasonably attributed to some fragment or fragments having been overlooked in the first instance.

It would be needless to enter into the details of the very large majority of cases which have been under my care, the patients having obtained complete and permanent relief without any dangerous symptoms or other ill consequences. Those which form an exception to this general rule, may be distributed under the following heads :

First. Cases in which there was a fatal result, arising solely from the operation itself.

Secondly. Cases in which a similar result was to be attributed to the coexistence of some other disease, brought into an active state by the shock of the operation, but which disease would in itself have been sooner or later the cause of death, even if the operation had not been performed.

The cases which belong to the first of these divisions are five in number.

I have already referred to four cases, which occurred in the early part of my practice, in which the urethra had been lacerated in withdrawing the forceps loaded with calculous matter. In two of these the patients died.

In one of them, urinous effusion took place behind the triangular ligament of the perineum, causing extensive sloughing of the cellular membrane in the immediate vicinity of the prostate gland and neck of the bladder.

In another case, the effusion took place in the perineum behind the scrotum. As soon as it was discovered the perineum was freely divided ; but great constitutional disturbance followed, attended with acute inflammation of the lining membrane of the bladder, and an immense secretion of adhesive mucus, under which the patient sank and died.

In a third case, a calculus of very moderate size was crushed without the smallest difficulty. The operation was followed by a rigor, which, not being relieved, as is usual, by a perspiration, terminated in an attack of fever, and

ultimately in the patient's death. There were no local symptoms whatever; the bladder being free from irritation; the urine remaining acid, free from mucus and pus, and there being no indication of renal disease. It certainly may have been otherwise, but it seems to me that the circumstances are best explained by supposing that the febrile disturbance of the system, of which the rigor was the precursor, was the actual cause of death. Unfortunately, the objections of the patient's friends to a *post-mortem* examination, prevented my having the opportunity of obtaining any positive information on the subject.

In a fourth case, a very small calculus was crushed with great ease by a single operation. The operation was succeeded by a rigor, which terminated, as is usual, in a perspiration. A disturbed state of the system followed, marked by a frequent pulse, a furred tongue, and much prostration of strength; and attended with a deposit of adhesive mucus, but not in large quantity, from the urine. These symptoms continued, and after some time an abscess presented itself in one groin. The abscess having been opened, a considerable discharge of matter took place, and was followed by great relief as to the general symptoms. The patient seemed to be in an improving state, when, between four and five weeks after the operation, he suddenly expired.

On examining the body, no remains of the calculus were discovered in the bladder. The mucous membrane of the bladder bore marks of inflammation. There was an abscess of the pelvis occupying the space between the bladder and rectum, and extending in the direction of the abdomen as high as the groin, in which the puncture had been made. The parts were carefully dissected and examined by the late Mr. Vincent (who had attended the patient with me in consultation), by Mr. Charles Hawkins, the Curator of the Museum of St. George's Hospital, and myself, but no lesion could be detected of the bladder, nor any kind of communication between the bladder or urethra, and the abscess. Still I cannot doubt that the abscess was somehow the result of the operation. Probably a very small splinter of the calculus

might have penetrated the coats of the bladder, allowing the escape of a very minute quantity of urine into the cellular membrane. This would be quite sufficient to account for an extensive suppuration, at the same time that it is easy to suppose that so small a puncture might at once have closed, so as to be invisible afterwards.

The fifth case was that of an elderly gentleman, in whom, after a calculus had been twice or three times crushed, inflammation of the mucous membrane of the bladder ensued, attended with little pain, but with a very large secretion of mucus, and great prostration of his bodily powers, under which he gradually sank and died.

In the three cases which follow, there seems to be no reason to doubt that the fatal result, though it immediately followed the operation, is more to be attributed to the existence of renal disease than to anything in the operation itself. Still, as in each of them the patient might have lived longer if it had not been had recourse to, we must admit them as examples of the operation being unsuccessful.

In one of these cases the patient, though apparently in good health otherwise, had been for some time liable to attacks of severe pain in the loins. A calculus, of a moderate size, was crushed without any difficulty, some of the fragments being withdrawn with the forceps afterwards. The operation was followed by a rigor. On the following day there was an attack of most intense agonizing pain in the loins, attended with a very frequent pulse, which lasted for several hours, and could be relieved only by opium. Several attacks of the same kind succeeded each other at various intervals, one of them being ushered in by another severe rigor. At first, on the pain subsiding, the pulse returned to its natural standard; afterwards there was no remission of the febrile symptoms; the patient was alternately drowsy and delirious. He gradually sank, and died twelve days after the operation.

The body was examined, with the assistance of Mr. Henry James Johnson, who attended the patient with me.

Some fragments of the calculus which had been crushed,

with three or four other calculi of a small size, were found in the bladder. The bladder and urethra, and parts immediately in connection with these, were in a perfectly healthy state.

The left kidney was enlarged to nearly double its natural size, and of a dark red colour, from excessive vascularity. The investing membrane adhered more closely to the surrounding adeps than to the kidney itself. When it had been removed, numerous small deposits of straw-coloured lymph were found interposed between it and the glandular structure. The mucous membrane of the pelvis and infundibula was inflamed, and contained a considerable quantity of muco-purulent fluid. There was no disease of the right kidney.

Another case was that of a gentleman who, besides the usual symptoms of calculus of the bladder, suffered from the effects of an enlargement of the prostate gland, which prevented him from being able to empty the bladder by his own efforts. The urine, when drawn off by the catheter, was turbid, and deposited some mucus afterwards.

After the first crushing of the calculus the patient had a rigor, which, however, was followed by no ill consequence. The bladder was emptied at regular intervals by means of a catheter having a large aperture, at the same time being washed out daily with tepid water. In this manner a large quantity of the broken down calculus, consisting of the mixed phosphates, was brought away.

The operation was not repeated until after the expiration of a fortnight. It was again followed by a rigor, and by another on the succeeding day. From the effects of this last rigor the patient never recovered; and he died on the third day after the second operation.

On examining the body after death, the prostate gland was found enlarged, and forming a tumour, projecting into the bladder, of the size of an ordinary plum.

The mucous membrane was rather more vascular than under ordinary circumstances, and the muscular tunic was somewhat increased in thickness, but not more so than in

most other cases of enlargement of the prostate gland. In other respects the bladder and urethra were in a sound state.

The kidneys were of a dark red colour, from excessive vascularity; and, on separating the investing membrane, numerous small deposits of pus were found beneath it imbedded in the glandular structure.

In the following case, as long a period as six weeks elapsed between the last operation and the death of the patient; nevertheless, I cannot do otherwise than refer it to the same class as the two preceding; as, although, he laboured under a disease from which he could not have ultimately recovered, we must suppose that the fatal termination of it was hastened by the operation.

The patient was under my care in St. George's Hospital, labouring under calculus of the bladder, complicated with general ill health, but at first having no symptoms indicating any immediate danger. The calculus was crushed by five operations, at intervals varying from five to thirteen days. During this process he had several severe rigors. From the time of the last operation he was free from pain, but the urine was alkaline, depositing a good deal of adhesive mucus, with great general debility, increasing until he died.

On examining the body, one kidney was found to be enlarged to double its natural size, with numerous abscesses, from the size of a pin's head to that of a pea, imbedded in the glandular structure. The mucous membrane of the pelvis and infundibula bore marks of inflammation, and was encrusted with phosphate of lime. The opposite kidney exhibited similar marks of disease, but to a less extent. The prostate gland was a good deal enlarged; the mucous membrane of the bladder was inflamed, and the muscular tunic thickened.

As it is my wish to give an exact account of the results of my own practice, I shall add to this list of casualties a notice of another case in which the death of the patient took place shortly after the operation; but under circum-

stances which make it at the least very doubtful whether the operation had in any way contributed to it. The patient was an elderly gentleman, and the calculus was of a large size. It was crushed without any difficulty, but several operations were required, occupying altogether a period of three or four weeks. No unfavorable symptoms presented themselves, except that the patient, who was naturally of what is called a nervous temperament, was on the whole in a desponding state of mind, taking an unfavorable view of his own condition. However, he seemed to have perfectly recovered, and had begun to resume his usual habits, when he was seized with a severe attack of diarrhoea, which did not yield to the usual treatment, and after a few days proved fatal.

Mr. Keate had seen the patient with me in consultation, and Mr. Charles H. Johnson had assisted me in the various operations, and in my absence from London, they examined the body without finding any morbid appearance except that one kidney was somewhat larger and more vascular than under ordinary circumstances.

I am not aware that among the cases which have been under my care, there have been any besides those which have been now enumerated, in which the operation can be considered as having either caused or accelerated the patient's death. In by far the greater number of instances the entire destruction of the calculus is immediately followed by relief from all the former symptoms, the bladder being no longer irritable, and the urine being free from mucus. It occasionally happens, however, that after the cure is completed, or supposed to be completed, the mucous membrane of the bladder remains in a more or less inflamed state, indicated by a frequent desire to void the urine, and a deposit from the latter of adhesive mucus. This may arise from a fragment of the calculus having been overlooked, in which case the symptoms will continue until such fragment has been detected and crushed. It may arise also from the calculous disease having been complicated with disease

of the prostate gland, or of the bladder itself; and it is, moreover, one of the numerous ill consequences of a too rough manipulation on the part of the surgeon, or too long protracted operations. The symptoms here referred to, if merely the result of the operation, generally subside in the course of a fortnight, with little other treatment than that of keeping the patient in a state of repose, and chiefly in a recumbent position on a sofa.

§ 3.

It would be unreasonable to expect that any method of treatment for the relief of a disease so certainly fatal if left to itself, and productive of so much misery, as calculus of the bladder, should be constantly and uniformly successful. If lithotomy has its dangers, lithotripsy has its dangers also; and the only question for the practical surgeon to consider, is, which is the least dangerous of the two. Of the nine cases which I have enumerated it may well be doubted as to one of them whether the attack which was the immediate cause of the patient's death was really connected with the operation; while in two others, the fatal result was to be attributed to a mode of performing the operation which my later experience has led me to abandon. But, even if we admit the whole nine cases as a fair example of the average failure of the operation, the proportion of deaths to recoveries is somewhat less than 1 in $12\frac{1}{2}$.

In order that I might compare this with the proportion of deaths from lithotomy, I have referred to a paper by the late Mr. R. Smith, of Bristol, published in the Eleventh volume of the 'Transactions' of this Society, and entitled '*An Inquiry into the Statistics of Stone in the Bladder,*' and I there find it stated, that in the Bristol hospital, during a series of many years, the average of deaths after lithotomy was 1 in $4\frac{1}{2}$; in the hospital at Leeds, 1 in 5; and in the hospital at Norwich, 1 in $7\frac{1}{4}$.

Thirty-five years have elapsed since the publication of these statements, but there is no reason to believe that the

success of lithotomy is greater now than it was when Mr. Smith collected his observations. The editor of a weekly journal (the 'Medical Times and Gazette'), has for some time past published the statistics of the various operations performed in the London hospitals, including lithotomy. The facts seem to have been collected with some care, and are probably a near approximation to the truth. Mr. Charles Hawkins has been at the pains to collect from the various numbers of that journal published during the year 1854, the facts relating to lithotomy, and it appears that of 59 patients who underwent that operation as many as 10 died, being in the proportion of rather more than 1 in 6.

But here two other facts must not be overlooked, without which no just comparison can be made of the results of the two operations. First, while cases of vesical calculus in children under the age of puberty, in private practice, and among the more affluent classes of society are of rare occurrence, they form the very great majority of those which are admitted into hospitals; and, secondly, the proportion of deaths after lithotomy among children is very much less than it is among adults. Both these facts are sufficiently obvious to those who have had the opportunity of witnessing the practice of our larger hospitals. From the data furnished by the medical journal to which I have already referred, it appears that in the London hospitals during the last year children formed a small fraction more than three fourths of the whole number of those who underwent lithotomy; that among them the deaths were in the proportion of 1 to 14 recoveries; while among adults the deaths and recoveries were equal. That in this instance the large proportion of deaths among adults was beyond the average, and depending on accidental circumstances, cannot well be a matter of doubt, and indeed it is plain that no general rule can be drawn from the limited number of cases which occur in the space of a single year. Still, as even in the Norwich hospital, where there is reason to believe that lithotomy has been on the whole more successful than in any other public institution, the proportion of deaths among adults is reported

to have been four times as large as that among children¹ it is evident that the difference in the degree of danger at these two periods of life is very great; and it must always be borne in mind that, in estimating the comparative value of the two operations, it is only the results met with in adults that should enter into our calculations.

My own experience has certainly led me to the conclusion, that lithotrity, *if prudently and carefully performed, with a due attention to minute circumstances*, is liable to a smaller objection than almost any other of the capital operations of surgery. The cases to which it is not applicable are very few indeed, and they are chiefly those in which, from the calculus having attained an unusual size, the danger and difficulty of lithotomy are so great, that no surgeon would willingly, nor otherwise than as a matter of duty, undertake it.

¹ 'Medico-Chirurgical Transactions,' vol. xi, p. 32.